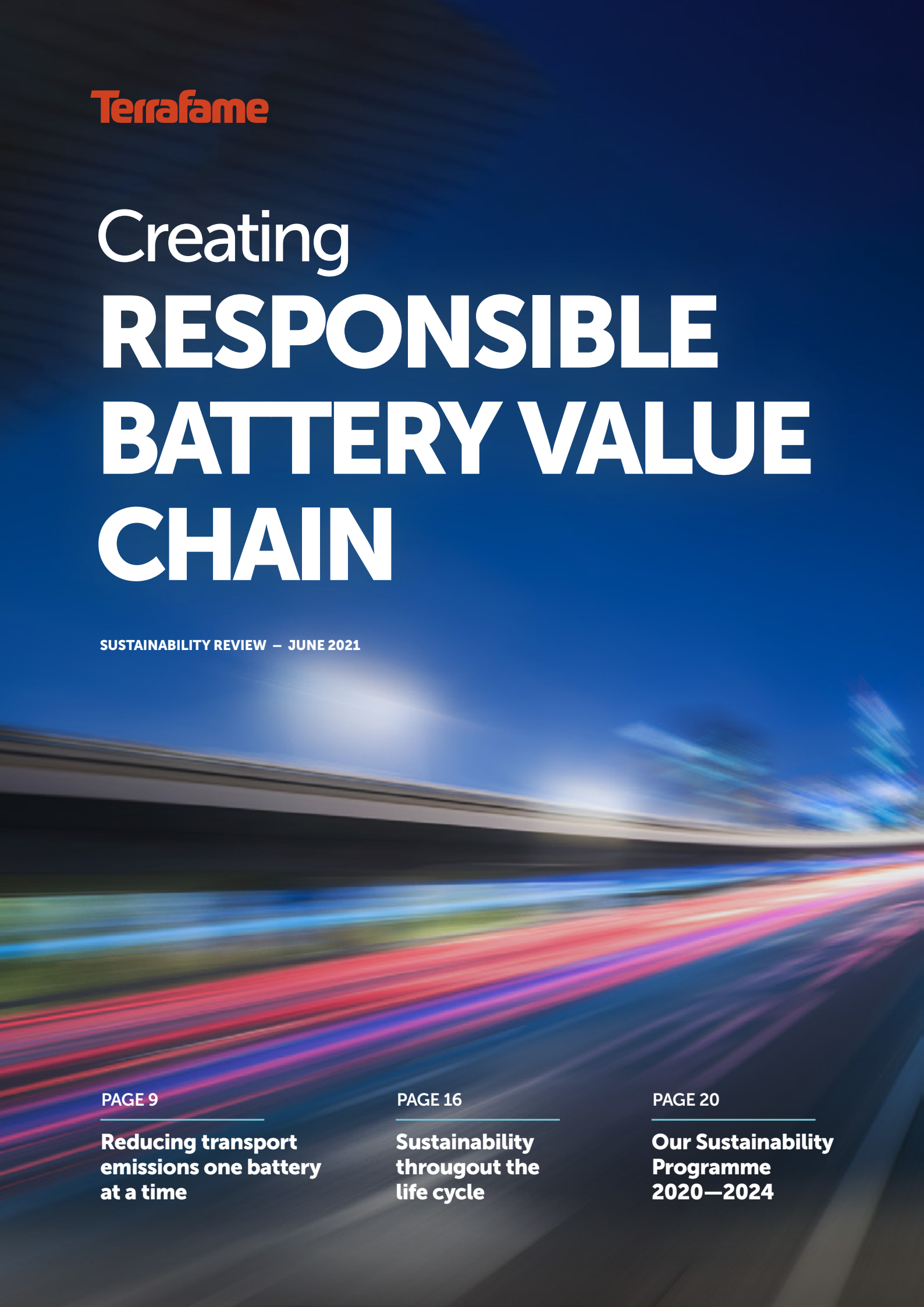
Terrafame

Creating RESPONSIBLE BATTERY VALUE CHAIN

SUSTAINABILITY REVIEW – JUNE 2021



Terrafame

BUSINESS MODEL

Enhancing low-carbon mobility with responsible battery chemicals

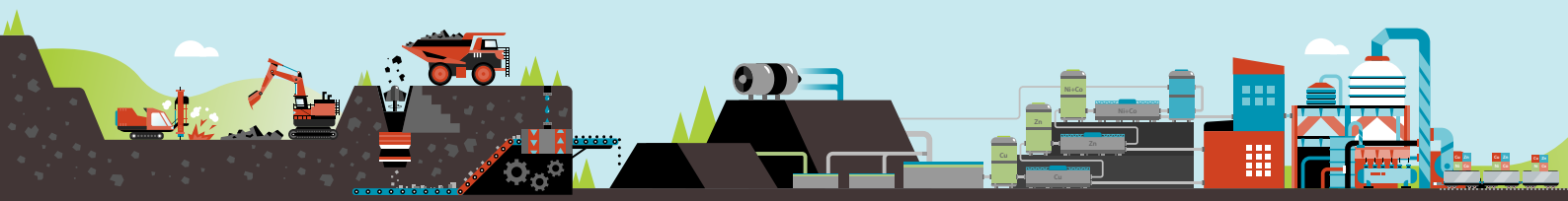
IMPACTS

Economic value-added – Committed personnel – Safe working environment – Solid customer experience

TRACEABLE SUPPLY CHAIN, LOW CARBON FOOTPRINT

INTEGRATED AND ENERGY EFFICIENT PRODUCTION

Open pit — Materials handling — Bioleaching — Metals extraction — Battery chemicals plant



RESOURCES

Largest nickel ore reserves in Europe – Skilled personnel – Wide partner company network

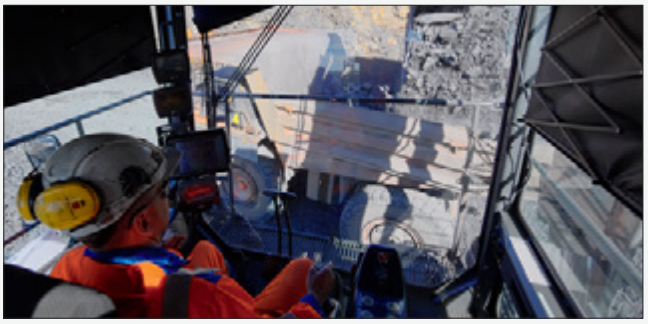
VALUES

Safety – Commitment – Efficiency

A unique integrated production process

Terrafame's integrated production process – which begins in its own mine and ends with battery chemicals on one industrial site – is a unique and energy-efficient production chain that provides customers with battery chemicals that have a markedly smaller carbon footprint compared to the industry average.

The production process starts at our own open pit, from which the ore is mined. The ore is then crushed, agglomerated and transported and stacked to bioleaching heaps.



The bioleaching process utilizes microbes to extract metals from the ore. Air is blown into the heaps and they are irrigated with an acidic production solution. This creates optimal conditions for the microbial activity within the heaps. The stacked ore is first leached in the primary heap for about 15 months. The ore is then reclaimed and conveyed onto a secondary heap for final leaching. Bioleaching is an energy efficient production method.

Metals are extracted from the recyclable production solution, which is precipitated in stages into nickel-cobalt, zinc and copper sulphides in a metals recovery plant. Zinc and copper sulfides are filtered and sold for refining.

The nickel-cobalt sulphide is fed into the battery chemicals plant which is located at the same industrial site. There the nickel-cobalt sulphide is further processed into nickel and cobalt sulphates ie. battery chemicals.

EDITORIAL

Sustainability is concrete actions

Terrafame's new battery chemicals plant produces nickel and cobalt sulphates for electric vehicle batteries. With the new plant, Terrafame is strongly linked to the battery value chain being built in Finland and Europe that enables the reduction of carbon dioxide emissions from transport. According to an expert report prepared in 2020, the carbon footprint of the nickel sulphate produced by Terrafame is around 60% smaller than the industry average. In practice, the difference arises from lower energy consumption than usual, because bioleaching does not require fine-grained ore and high temperatures are not needed in the process.

Although the carbon footprint of Terrafame's nickel sulphate has been proven to be small, measures have been taken to reduce it further. Since late last year, Terrafame has produced process steam, as well as district heat for buildings, in its new bio-heating plant. At the beginning of this year, the hydrogen plants needed for the process were equipped with waste heat recovery. The company aims for all electricity used in the area to be produced in a carbon-neutral manner in the future. One possibility to achieve this goal is to use wind power generated in nearby areas.

Naturally, sustainability is more than just the small carbon footprint of battery chemicals for Terrafame. We have compiled our key sustainability measures into a sustainability programme. Its themes have been linked to the UN Sustainable Development Goals and the UN Global Compact initiative, which we joined in October 2020. With regard to the sulphate load in local water bodies, which is an important issue to local stakeholders, our goal is to recycle 100% of the sulphate that ends up in water treatment from the production process back into the solution circulation. Only low-sulphate collection waters, to the extent that they are not used as raw water, are purified and directed out of the area. As part of this goal, we executed a development project based on a two-line run model at the centralised water treatment plant during 2020.

The safety of employees on the industrial site is our first priority. In occupational safety, we focused on the safety of our partners in particular on the industrial site by further improving our induction practices during 2020. We are also developing our employees' diversity and equality, in addition to investing in training.
In all our operations, we are committed to good governance and transparency. In 2020, we compiled our company's policies and guidelines into a Code of Conduct concerning all operators on the industrial site, including partner companies and operators in our supply chains. In early 2021, we introduced a whistle-blowing channel for the reporting of any misconduct.

The company is committed to comply with the principles of the Finnish Network for Sustainable Mining, and self-assessments and internal audits related to the tools included in the system were carried out during 2020. An external verification related to the system will be conducted in late 2021.

Veli-Matti Hilla
Chief Sustainability Officer
Terrafame Ltd

About Terrafame Ltd

Terrafame enhances low-carbon mobility by supplying the global battery industry with responsibly produced battery chemicals. At its industrial site in Finland, Terrafame operates one of the world's largest production lines for battery chemicals used in electric vehicle (EV) batteries. The plant has capacity to supply nickel sulphate for about one million electric cars per year. The carbon footprint of the nickel sulphate produced by Terrafame is one of the lowest in the industry average.

Terrafame's integrated production process – which begins in its own mine and ends with battery chemicals on one industrial site – is unique and energy-efficient. It provides customers with a transparent, traceable, and truly European battery chemicals production chain in a world of scarcity.

Terrafame Ltd was founded in 2015. In 2020, Terrafame's net sales amounted to EUR 338 million. The company's industrial site employs approximately 1,600 people, of which about half are employees of its partner companies.

About sustainability review

This Sustainability Review describes the progress of the company's Sustainability Programme. The review also describes the sustainability developments in the early 2021s. The review complements the non-financial report published as part of the 2020 Annual Report. Based on the 2020 Annual Report and Financial Statements and the Finnish Securities Market Association's Corporate Governance Code 2020 Reports on Corporate Governance Statement 2020, Remuneration Statement 2020 andVV the company's remuneration policy are available on the company's website at www.terrafame.com.

Contents

CEO'S REVIEW

We are fighting climate change together with our customers

Joni Lukkaroinen
CEO
Terrafame Ltd

At the time of publication of this sustainability review, Terrafame has just entered a new era: its three-year battery chemicals plant project has been completed, and the production ramp-up has started. The timing of the start-up of the production plant is good as demand for electric vehicles is growing strongly, and the European battery value chain is being built rapidly. Terrafame's fully integrated production chain, from its own mine to battery chemicals, provides customers with products that consistently meet their quality criteria.

However, meeting technical quality requirements is no longer enough. Social awareness of sustainable operations is increasing, and fighting climate change is a priority for many. Supply chains in the automotive industry are complex, and the battery value chain is no exception. Particularly in Europe, the entire battery value chain must be able to prove that its operations are sustainable and geared towards fighting climate change. Discussions with representatives of the automotive industry show that a strong commitment to sustainability is a prerequisite for cooperation. On the other hand, there are open discussions about the roles of various operators in the value chain in order to ensure the best possible result. After all, the

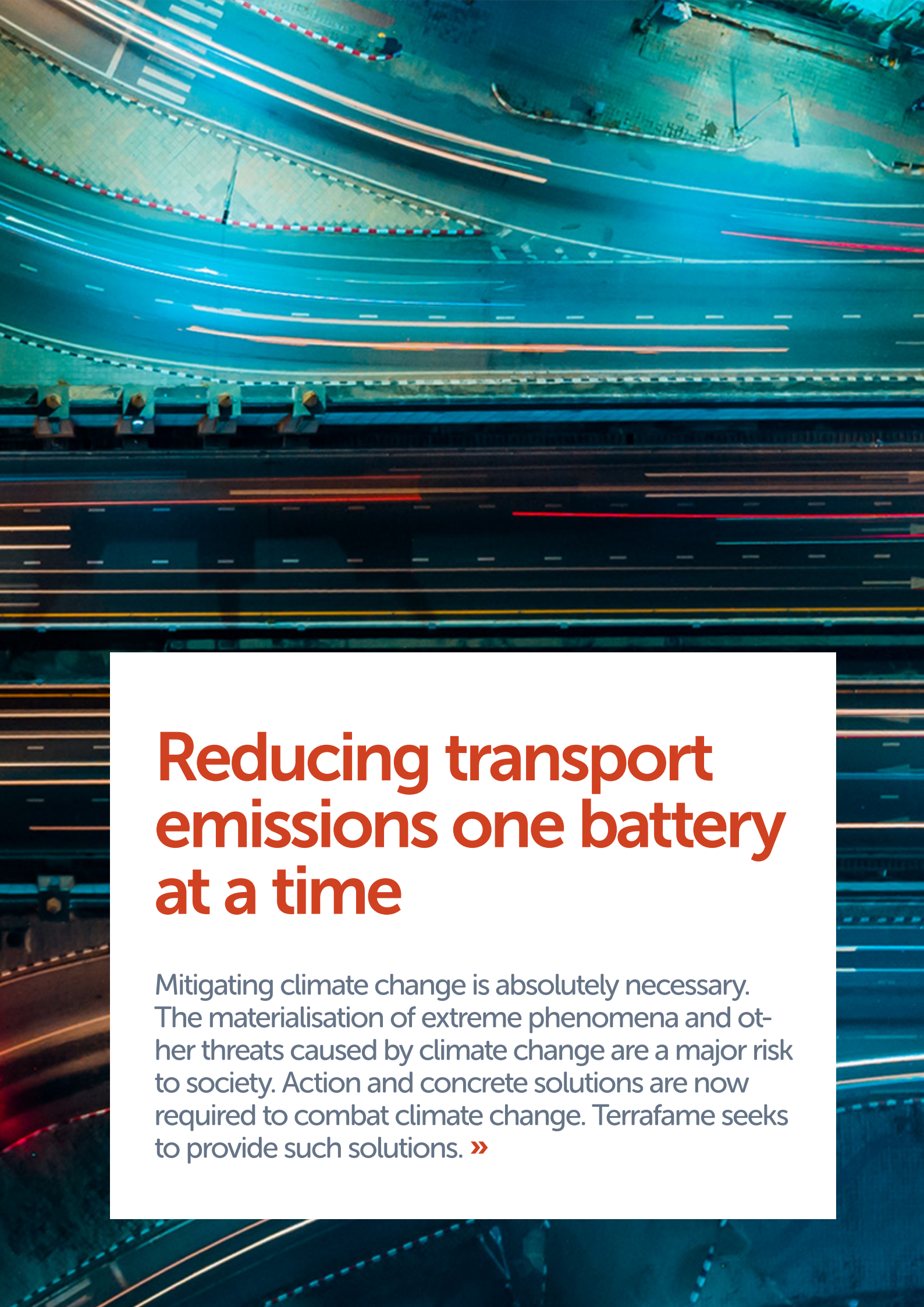
ultimate goal is to guarantee sustainably produced raw materials for the demanding customers of electric vehicle batteries.

Here at Terrafame, we take this challenge seriously. In our own production at one industrial site, we can ensure the transparency of the production process and the traceability of the products. The largest nickel ore reserves in Europe ensure the steady availability of raw materials for our production process and enable production to continue for decades to come. Based on studies by external research institutes, the carbon footprint of Terrafame's nickel sulphate is among the smallest in industry, which makes our contribution significant in terms of fighting climate change as part of the battery value chain.

In 2020, we compiled our company's sustainability measures and targets into a sustainability programme for 2020–2024, through which we are committed to continuously improving our operations. We are aiming to implement new commitments and international systems in the next few years to demonstrate the sustainability of our operations. These and other sustainability targets and measures are presented in more detail in the sustainability programme table included in this review.

> We are committed to continuously improving our operations.

Terrafame has integrated sustainability into its business operations. In practice, this means day-to-day responsibility for matters related to safety, the environment and stakeholders, as well as compliance with good governance. We are all responsible for operating sustainably. The concrete measures recorded in our sustainability programme show us the way in developing our own operations. Thanks to our unique integrated production process at one industrial site and the ensuing low carbon footprint, we can also genuinely join our customers in the fight against climate change.



Reducing transport emissions one battery at a time

Mitigating climate change is absolutely necessary. The materialisation of extreme phenomena and other threats caused by climate change are a major risk to society. Action and concrete solutions are now required to combat climate change. Terrafame seeks to provide such solutions. »

Terrafame promotes progress towards a lower-emission society and seeks to enable the electrification of transport through its operations in a responsible way.

The fight against climate change calls for major changes in our ways of living, consuming, manufacturing products and providing services. Completely new approaches must be developed in many sectors to reduce greenhouse gas emissions. Transport has significant adverse climate impacts: it causes almost 30% of all greenhouse gas emissions in the EU.

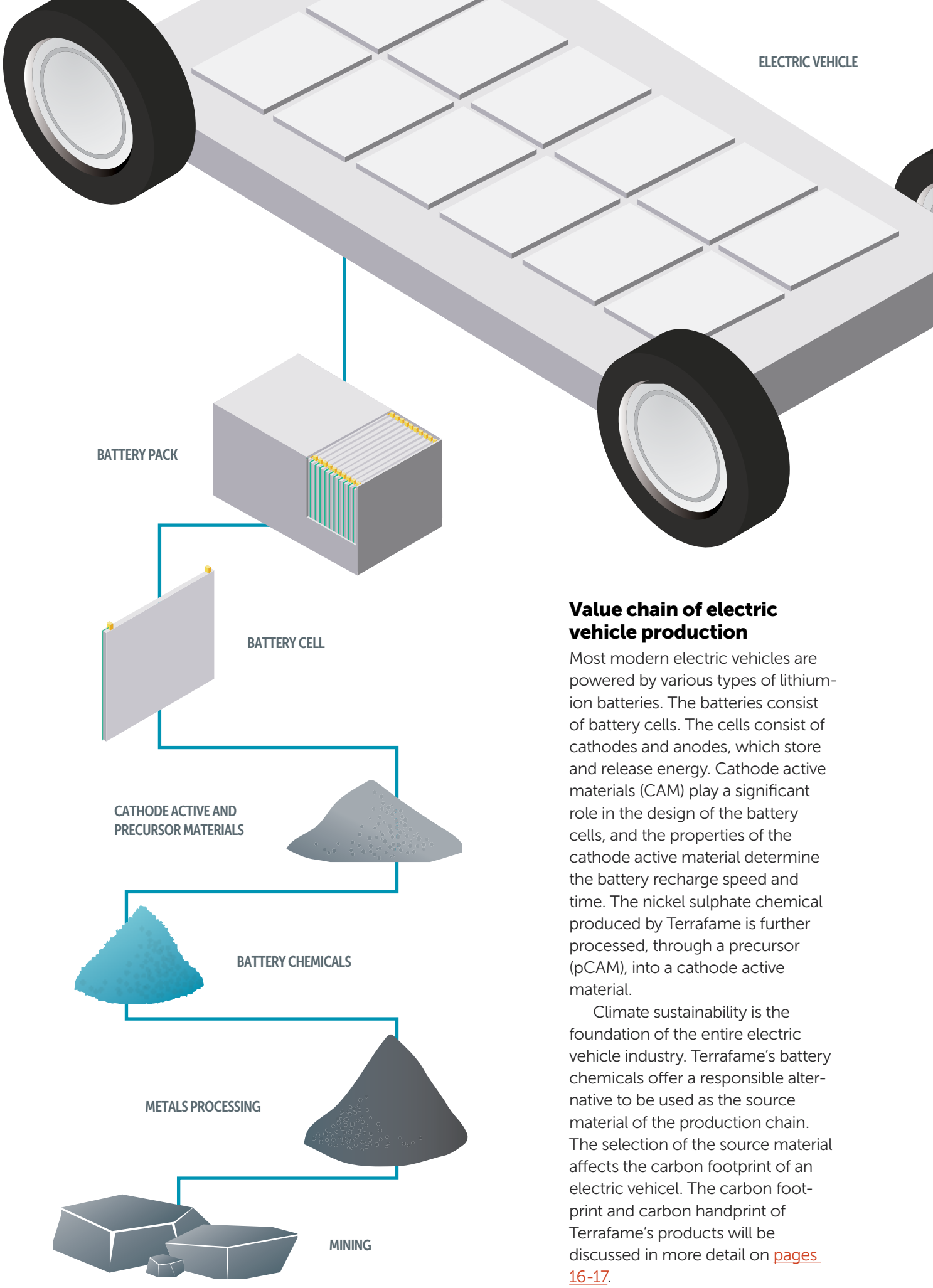
In the past year, many operators have been forced to make a big leap in the organisation of remote work, virtual services and events. However, not even the most extreme digitalisation will completely remove the need for the mobility of people and things. We need low-emission options.

Many countries have set ambitious targets for reducing emissions from transport. Regulation requires car manufacturers to increase the share of lower-emission cars. Numerous car manufacturers have acknowledged that change is inevitable, and have also realised the advantages of being a forerunner. Volvo, Jaguar, Bentley and Cadillac, for example, have announced that they will discontinue the production of cars with internal combustion engines by 2030 at the latest, or even five years earlier. Volkswagen has announced that it will discontinue the development of petrol and diesel engines from 2026.

The electrification of transport is the single most significant solution for reducing emissions from transport. In transport, electric vehicles generate no emissions at all. Emissions from electricity production are expected to decrease in the future, meaning that emissions from the electricity generated to run electric vehicles will also decrease. Considering the total life-cycle emissions per kilometre of a car, electric cars are typically more climate-wise options than cars with internal combustion engines. Forecasts of the pace and extent of transport electrification vary. However, it is certain that the number of electric vehicles will multiply during the current decade.

Terrafame promotes progress towards a lower-emission society and seeks to enable the electrification of transport through its operations in a responsible way. In 2018, we made a strategic choice to invest in a battery chemicals plant. This enables us to move forward in the value chain, from being a manufacturer of metal intermediates to being a special chemical company, and to play a more essential role in the value chain of electric vehicle production. In our own battery chemicals plant, we will further process our previous main product, nickel-cobalt sulphide, into nickel and cobalt sulphates to be used in the production chain of electric vehicle batteries.

Our new plant is one of the world's largest production units for nickel sulphates. The annual nickel sulphate capacity of the battery chemicals plant will be sufficient for around 1 million batteries for electric vehicles, and its cobalt sulphate capacity will be sufficient for around 300,000 batteries.



Value chain of electric vehicle production

Most modern electric vehicles are powered by various types of lithium-ion batteries. The batteries consist of battery cells. The cells consist of cathodes and anodes, which store and release energy. Cathode active materials (CAM) play a significant role in the design of the battery cells, and the properties of the cathode active material determine the battery recharge speed and time. The nickel sulphate chemical produced by Terrafame is further processed, through a precursor (pCAM), into a cathode active material.

Climate sustainability is the foundation of the entire electric vehicle industry. Terrafame's battery chemicals offer a responsible alternative to be used as the source material of the production chain. The selection of the source material affects the carbon footprint of an electric vehicel. The carbon footprint and carbon handprint of Terrafame's products will be discussed in more detail on pages 16-17.

TERRAFAME INDUSTRIAL SITE
BATTERY CHEMICALS PLANT
IN THE FOREFRONT

A unique process enables a new type of battery chemicals production

Terrafame is ready to start a new era in the company's operations. Production ramp-up was started at one of the world's largest production plants for nickel sulphate used in electric vehicle batteries at Terrafame's industrial site in June 2021. Terrafame's nickel sulphate has one of the smallest carbon footprint in

The strategic decision to invest in battery chemicals production was made in the autumn of 2018. In June 2021, almost three years of planning, design and construction have culminated in the commissioning of the new battery chemicals plant. The construction of the plant buildings next to the existing metal recovery plant was completed in January 2021. During the spring, equipment installations have been finalised, testing and test runs have been conducted, and the multi-stage set of processes has gradually been prepared for operation. Various tests have been carried out to ensure the functioning and safety of the production process and the quality of the special chemicals to be produced.

Up until this point, Terrafame's products have been intermediates: metal sulphides. Now the value added will increase. The feed for the battery chemicals plant is nickel-cobalt sulphide, the current main product. Its entire production volume will be processed into battery chemicals: nickel sulphate and cobalt sulphate. Ammonium sulphate will be generated as a by-product to be used as fertiliser.

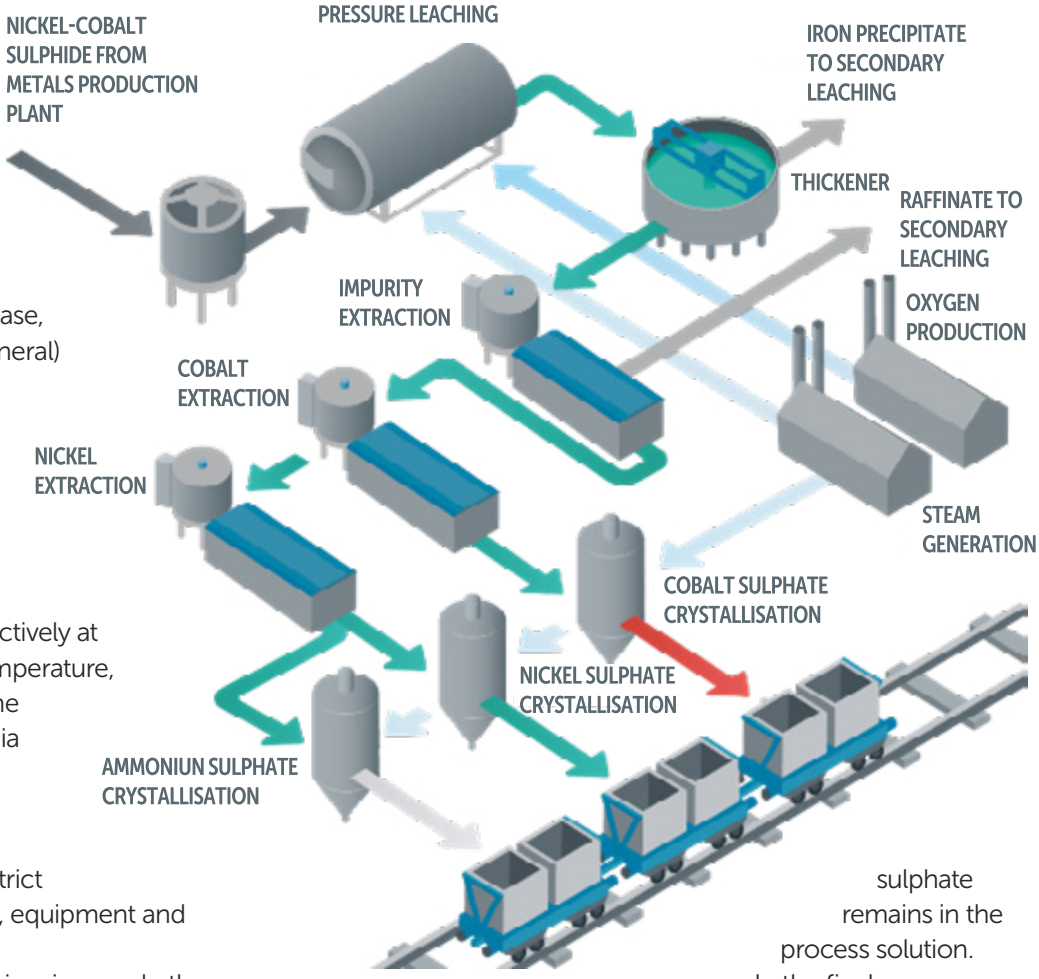
The plant is part of a unique chain where all the stages, from the quarry to the battery chemicals, are located at the same production site.

Juha Pekkarinen previously worked at the metal recovery plant. He is pleased with his transfer to the new battery chemicals plant at the turn of the year: "Battery chemicals production is an industry of the future. Participating in the commissioning has been interesting and has offered good insight into the process. The equipment suppliers have provided excellent training for process operations."

To ensure reliable operation and safety at the battery chemicals plant, experienced process industry professionals have also been recruited from outside the company. After a paper mill was closed in Oulu, **Pasi Räsänen** was laid off last year. He is pleased with his new employer. "I was impressed with Terrafame right from the start in the job interview. Working at the new plant has been interesting."

Jari Kuivisto also transferred from Oulu to Terrafame last autumn. "I was positively surprised by how easy the transfer eventually was. Working in a new field is inspiring, and the training has been of an extremely high quality." Jari is also pleased with the safety culture of his new working environment: "If a task cannot be carried out safely, it won't be performed at all."

Enabling sustainable mobility through the production of battery chemicals for electric vehicles is at the core of the plant's operations. Its design is therefore based on sustainability. The best available technologies have been selected for the plant to ensure that energy and materials are used as efficiently as possible, and that emissions are minimised. »



The battery chemicals plant process consists of three main phases: pressure leaching, solvent extraction and crystallisation. In the first process phase, the solid feed (sulphide mineral) is leached to solution form. This is conducted by oxidising the sulphur contained in the sulphide concentrate into sulphate in the pressure leaching, using surplus oxygen. The leaching is carried out effectively at increased pressure and temperature, using pure oxygen. After the pressure leaching, ammonia water is used to adjust the pH of the solution. The demanding conditions of the pressure leaching set strict requirements for materials, equipment and safe use.

After the pressure leaching, iron and other impurities are removed from the solution. Then the purified solution, which contains valuable metals, is led to the next phase: three-step extraction. The second process phase, extraction, is a separation method through which the desired substances are separated from the metal solution using an organic extraction reagent based on ion exchange. In its process, Terrafame uses three different organic extraction reagents to separate out the desired metals from the solution.

The first extraction step is purification extraction, which separates the remaining impurities (e.g. calcium, iron, copper and zinc) from the solution. The removed impurities are returned to the bioleaching, where the copper and zinc are recovered as sales products.

The next process phase is the separation and purification extraction of cobalt. In this phase, a cobalt-selective reagent extracts cobalt from the process solution, and the cobalt can be separated as a pure cobalt sulphate solution. In the final extraction stage, nickel is extracted selectively, and can be separated as a pure nickel sulphate solution. Only ammonium sulphate remains in the process solution.

In the final process phase of the battery chemicals plant, product chemicals are converted into their final solid form. As final products, Terrafame sells high-quality special chemical crystals to its customers. The nickel, cobalt and ammonium sulphate solutions produced during the three extraction stages are each fed into their own crystallisation processes to evaporate the water from the solution gradually. Only solid final products remain. Their high quality is ensured through selective extraction, the effective washing of product crystals, controlled process cycles and the accurate control of process values.

Statistical process control methods are used to support process control and product quality management.

Nickel and cobalt products are packed in bulk bags using automatic packaging machines, and the bags are sent to customers in sealed shipping containers. The shipping containers are transported from Terrafame's production site in Sotkamo Finland to ports by rail. The ammonium product is sold as a bulk product and delivered to customers by trucks.

Energy and material efficiency solutions

Side stream from the solvent extraction

The side stream generated during the first extraction phase is acid and contains substances classified as impurities in terms of battery chemicals production. In biological heap leaching, acid is required to maintain the required acid conditions in the heaps. By recycling the acid side stream from extraction to biological heap leaching, the need for acid in biological leaching can be covered almost completely.

Vapour recompression

Mechanical vapour recompression (MVR) was selected as the product crystallisation technology because of its energy efficiency. When using the recompression technology, cooled vapour from crystallisation is mechanically compressed into a smaller volume, which causes its temperature to rise, and it can be recycled back to the crystallisation phase. Vapour recycling reduces the need for primary steam in crystallisation by around 75% compared with traditional evaporation and crystallisation technology.

Heat recovery

The leaching reactions in the pressure leaching are exothermic, meaning that they generate heat. Heat is recovered from the cooling cycle of the autoclave to be used to heat process facilities. Terrafame is also exploring other opportunities to recover and reuse heat.

Water recycling

Water evaporated in crystallisation is recycled to be used as dilution water for used chemicals and is used in washing, which reduces the need for water produced by Terrafame's water plant.

Selection of the neutralisation chemical

The impacts on the amount and quality of waste and emissions generated were also taken into account in the selection of the neutralisation chemical and in process design. Ammonia was selected for neutralisation. During the process, it forms ammonium sulphate, a commercial by-product used in the chemical industry and as a fertiliser. Thanks to the selected neutralisation chemical and the recovery of ammonium sulphate, the battery chemicals production process does not increase the concentration of nitrogen or sulphate in the water discharged to natural waterways.

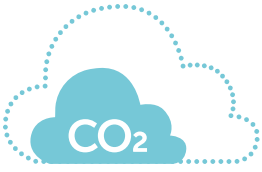
Sustainability throughout the life cycle

Terrafame is involved in creating the clean mobility industry and climate-sustainable battery production. The company fights climate change by participating in the production chain of electric vehicles. This is achieved by producing battery chemicals whose greenhouse gas emissions are markedly lower than industry average and by having a positive impact on customers' climate impacts.

Climate sustainability is a prerequisite for the existence of the electric vehicle industry. The main goal of the industry is to reduce carbon dioxide emissions from mobility. In transport, electric vehicles generate no emissions at all. However, realistic comparisons between various modes of transport require consideration of the entire life cycle, because greenhouse gas emissions are generated during the production of an electric vehicle. To minimise life-cycle emissions, it is important that the operators involved in electric vehicle production chains take emission intensity into account when selecting raw materials.

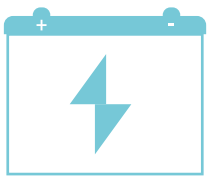
There are significant differences in emission intensity between nickel producers. Analyses published in 2020 by Skarn Associates and CRU show that the nickel produced by Terrafame using a bioleaching process has the world's smallest carbon footprint among nickel producers. This makes Terrafame's current intermediate an ideal raw material for battery chemicals.

In addition, a life-cycle assessment was conducted in 2020 concerning Terrafame's nickel sulphate product. A life-cycle assessment covers the environmental impacts of the entire production chain of the product. In Terrafame's case, this includes the impacts of quarrying, ore handling, bioleaching, metal recovery and nickel sulphate production. The assessment covers not only the direct environmental impacts, but also the impacts of producing the necessary chemicals and the energy used. The life-cycle assessment was conducted by Sphera Solutions GmbH, and its quality and compliance with standards was verified by Professor Matthias Finkbeiner from the Technical University of Berlin as an independent third party.



60% lower

Terrafame's nickel sulphate has on of the smallest carbon footprint in the industry



Terrafame's nickel sulphate improves customers' climate impact

The environmental impacts of Terrafame's products were compared with the industry average, which was based on a life-cycle assessment study conducted by the Nickel Institute, based on data collected from its members.

The results of the life-cycle assessment confirmed the conclusion that Terrafame's nickel sulphate product is a climate-wise choice, considering the entire life cycle of an electric car.

The greenhouse gas emissions from our chosen technologies are considerably lower than the industry average. In our production process, the carbon footprint per a nickel sulphate kilo produced is 1.75 kg CO_2e, with the industry average being 5.4 kg CO_2e.

The main reason behind the smaller carbon footprint of Terrafame's product is its energy-efficient production process. Terrafame's production process is based on bioleaching, and it uses around 90% less electricity and heat than average in the production of nickel sulphate. Most of the emissions from Terrafame's production process are generated during the production of the auxiliary agents, such as chemicals.

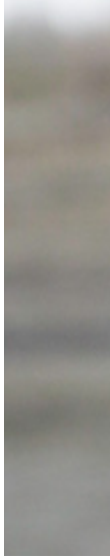
CONTINUOUS DEVELOPMENT

New energy solutions reduce carbon footprints

Terrafame is working actively to reduce the carbon footprints of products. The introduction of a heating plant running on bio-based fuel in November 2020 was a significant step. Implemented by Adven, the 10 MW heating plant produces steam and thermal energy for the production of battery chemicals and for other needs on the industrial site. Fossil fuels were previously used to produce steam and heat, but they have now been replaced with side streams from the Finnish forest industry and with recycled wood. This significantly reduces carbon dioxide emissions from energy production and thereby also reduces the carbon footprint of the battery chemicals produced.

Terrafame trains employees for its own needs – and also for regional needs

Terrafame's investment in a battery chemicals plant has led to the creation of many new jobs in the Kainuu region. Because of its significant recruitment needs, the company adopted an active approach to training for its future employees.



The focus of Terrafame's production has shifted towards low-carbon battery chemicals, which is why the company needs new types of competences. The the battery chemicals plant produces chemicals for electric vehicle batteries, the plant employs around 170 people directly, and a total of around 500 people when its indirect employment impacts are taken into account.

Around one-third of the employees of the battery chemicals plant have transferred there from Terrafame's other departments. Another third are experienced process technology experts from outside the company, and the remaining third will be employed through Terrafame's apprenticeship training programme. In this group, extensive experience is combined with fresh perspectives.

The need for new competences was recognised early into the investment decision-making process. The planning of the apprenticeship training programme was also based on this need.

The training programme was launched in cooperation with Kainuu Vocational College and Educational Consortium OSAO in 2019, and it has attracted a great deal of interest in Kainuu and its neighbouring regions. One of the reasons for this interest is the fact that students with various backgrounds are eligible as long as they have completed their upper secondary education. Previous experience in the field is not the most important selection criterion; instead, attention is paid to the student's level of motivation and their ability to learn new and make a commit themselves. When their inner motivation is at a good level, the student will be more successful than average. In such a case, most of the selected students also feel that their studies are meaningful and will complete their education.

Through tailored apprenticeship training, Terrafame is able to provide training for the experts it needs. **Toni Korhonen** is completing the final year of his apprenticeship training. He says that the studies have been interesting: "The best aspects have been the opportunity to fully focus on and thoroughly familiarise myself with the work, and learning something new every day."

The coronavirus pandemic broke out in early 2020 and affected Terrafame's day-to-day operations in many ways, including the provision of training.

TRAINING MANAGER
PAULI PYYKKÖNEN

The groups have been made smaller, and distance learning has been increased. The year has also been unique for the students in other ways. There is rarely an opportunity for students to follow the construction and start-up of their future workplace as closely as in the case of the battery chemicals plant. For example, the students have been able to familiarise themselves with the equipment during its assembly.

In addition to providing apprenticeship training, Terrafame has invested in process technology training by donating a three-year principal lecturer position to Kajaani University of Applied Sciences. The donation enabled the university to restart its degree programme in process technology after 13 years in the autumn of 2020. As well as recruiting new employees, Terrafame offers further training in electrical and automation engineering, for example, for its existing employees.

The purpose is not to invest in training only for the company's own needs. The goal is also to systematically increase the number of professionals in the field in the Kainuu region. Through its responsibility programme, Terrafame is committed to training more than 100 process industry professionals both for its own needs and other process industry needs by 2024.

According to **Heini Hämäläinen**, Chief HR Officer, Terrafame has an obligation to further develop process expertise in its region. "We are a major employer, and professional development is one of the key aspects of our social responsibility. It enables us to support our employees' various career paths and increase the level of expertise in the whole of the Kainuu region."

Over the past two years, a total of 75 students have started the apprenticeship training programme. The first group graduated in March 2021, and 17 of the 20 students are continuing to work for the company under employment relationships that are valid until further notice. A total of 49 students are participating in the apprenticeship training programme in groups that started in the autumn of 2019 and spring of 2020.

Training Manager **Pauli Pyykkönen** is pleased with Terrafame's active role in providing high-quality training. "We have an excellent group of professionals, from recent graduates to experienced experts. I'm convinced that the start-up of the battery chemicals plant will run smoothly and successfully."

Terrafame's sustainability programme 2020–2024

All Terrafame's operations are based on sustainability and continuous improvement. In 2020, we further developed our systematic approach to continuous improvement, as well as its monitoring, by compiling our sustainability measures and targets into a sustainability programme for 2020–2024. For the programme, based on the views of our company's representatives and stakeholders, we determined the most material sustainability themes for our business operations and set concrete targets for ourselves. We linked the themes of our sustainability programme to the UN Sustainable Development Goals as far as applicable.

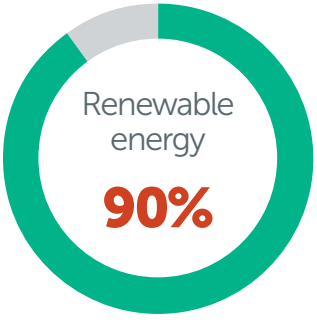
We are continuously developing our sustainability programme. In October 2020, as part of our systematic approach to operations and reporting, we joined the UN Global Compact initiative, which provides an internationally approved framework for demonstrating sustainability. The commitment guides us towards more comprehensive sustainability development and provides us with practical tools and good practices.

What does sustainability mean to us? We have a comprehensive approach to sustainability through the environment, social responsibility and good governance. We are aware that there is still room for improvement in our operations, but we are committed to the continuous improvement model, supported by our ambitious targets for 2024.

Our sustainability programme was published in the summer of 2020, and now it's time for the first annual review. The sustainability programme table shows what measures we have taken over the last year, how we have progressed towards our targets and what measures are being planned. The table has now been supplemented with sections related to UN Global Compact reporting, which were reported in text format in last year's sustainability review.

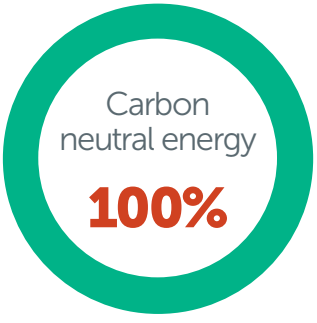
Selected Sustainability Programme targets for 2024

Of the sulphate form the process ending up in water treatment, 100% is recycled back into the bioleaching.



Over 90% of steam and heat production is carried out with renewable energy.

The recovery rate of conventional municipal and industrial waste is over 95%.



Carbon neutral energy accounts for 100% of electricity.

UN SUSTAINABLE DEVELOPMENT GOALS

GLOBAL COMPACT

The Ten Principles of UN Global Compact

Human rights

1. Businesses should support and respect the protection of internationally proclaimed human rights; and
2. make sure that they are not complicit in human rights abuses.

Labour

3. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
4. Businesses should uphold the freedom of association and the effective recognition of the right to collective bargaining;
5. the effective abolition of child labour; and
6. the elimination of discrimination in respect of employment and occupation.

Environment

7. Businesses should support a precautionary approach to environmental challenges;
8. undertake initiatives to promote greater environmental responsibility; and
9. encourage the development and diffusion of environmentally friendly technologies.

Corruption

10. Businesses should work against corruption in all its forms, including extortion and bribery.

COMMUNICATION ON PROGRESS

UN GLOBAL COMPACT

This is our **Communication on Progress** in implementing the Ten Principles of the **United Nations Global Compact** and supporting broader UN goals.

We welcome feedback on its contents.

Policies and operating principles guiding sustainability work

- Code of Conduct
- Company's policies
- Corporate Governance Code 2020 (Securities Market Association)
- UN Global Compact commitment
- ILO Declaration on Fundamental Principles and Rights at Work
- Finnish Towards Sustainable Mining (TSM) standard of the Finnish Network for Sustainable Mining

Topics of the sustainability programme

ENVIRONMENTAL RESPONSIBLITY

- Products
- Energy efficiency and carbon footprint
- Loading to natural waterways
- Water treatment sludge and local lakes
- Reuse of waste

SOCIAL RESPONSIBILITY

- Personnel and equality
- Safety
- Training
- Regional economy

GOOD GOVERNANCE

- Fairness and good governance
- State corporate governance decision 2020
- Corporate Governance Code 2020
- Standardized management system
- Social Responsibility principles

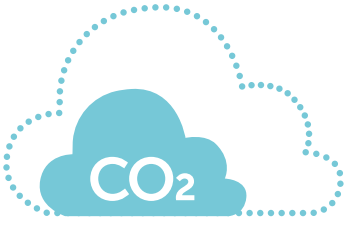
Products

Climate sustainability is a prerequisite for the existence of the electric vehicle industry. Terrafame produces battery chemicals with a small carbon footprint, and the company has several measures in progress to reduce its carbon footprint.

UN Sustainable Development Goals 8 (Decent Work and Economic Growth), 9 (Industry, Innovation and Infrastructure) and 13 (Climate Action).

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
Our current products (nickel-cobalt sulphide and zinc sulphide) are intermediates with a high enrichment rate. A significant portion of the nickel-cobalt sulphide is processed elsewhere into nickel and cobalt sulphates, which are battery chemicals. The construction of our own battery chemicals plant is underway.	Battery chemicals plant's buildings were completed in January 2021. The plant started the ramp-up of its production operations in 2021. The plant will produce battery chemicals (nickel sulphate and cobalt sulphate), as well as ammonium sulphate as a by-product. Zinc will be produced as high-quality zinc sulphide as before.	The battery chemicals plant received its environmental permit in January 2021. Its environmental impacts during its start-up will be monitored in accordance with what has been agreed with the local Centre for Economic Development, Transport and the Environment. At the same time, an environmental monitoring plan for the battery chemicals plant will be prepared for approval by the authorities. After ramp-up, the operations of the plant will be monitored in accordance with the approved monitoring programme.	The annual production capacity is 170,000 tonnes of nickel sulphate and 7,400 tonnes of cobalt sulphate. The annual nickel sulphate production is sufficient for around 1 million electric vehicles, and the annual cobalt sulphate production for around 300,000 electric vehicles. Around 115,000 tonnes of ammonium sulphate per year will be produced for the fertiliser industry. The ammonium sulphate will be a side stream of the nickel and cobalt sulphate production, meaning that raw materials will not be used solely for ammonium sulphate production. More than 100,000 tonnes of zinc sulphide will be produced annually for anti-corrosion and other purposes, which promotes sustainable construction.
On 6 February 2020, the Finnish Government granted a uranium extraction permit to Terrafame. The permit is yet to enter into force. We have legally valid environmental and chemical permits for uranium extraction.	The Supreme Administrative Court gave its decision on the matter on June 24, 2021.	Terrafame consideres starting the extraction of natural uranium if it is viable from the business perspective.	The natural uranium will be sold to reliable partners for further processing for energy production. After its further processing, Terrafame's natural uranium will be used as fuel for nuclear power plants. The planned uranium production capacity corresponds to around 12% of the total electricity consumption in Finland.

CARBON FOOTPRINT



Terrafame's carbon footprint is the smallest of the nickel producers

The production technology utilized by Terrafame enables low greenhouse gas emissions. The carbon footprint of the nickel sulphate produced by the company is 60 percent lower than the industry average.

Energy efficiency and carbon footprint

The production of energy for the process has a significant impact on the carbon footprint. Terrafame has transferred to the use of renewable energy in the production of steam and district heat, and the company is exploring possibilities to use wind power, for example. Process design and development are guided by an aspiration towards energy efficiency and the exploitation of waste energy streams.

UN Global Compact: **Environment** (Principles 8 and 9)
UN Sustainable Development Goals **7 (Affordable and Clean Energy)** and **13 (Climate Action)**

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
The carbon footprint of metallic nickel made from our current nickel product is up to 40% smaller than the industry average for similar products.	Analyses published in 2020 by Skarn Associates and CRU show that the nickel produced by Terrafame using a bioeaching process has the world's smallest carbon footprint among nickel producers. A life cycle assessment (LCA) of the carbon footprint of nickel sulphate was carried out according to plan in 2020. The results show that the carbon footprint of Terrafame's nickel sulphate is around 60% smaller compared with the average production method. These studies prove that we have achieved the goal we set in 2020: the carbon footprint of Terrafame's nickel sulphate is at least 50% smaller than that of nickel sulphate produced using commonly used technologies.	We will study what measures would enable Terrafame to achieve carbon neutrality and by what time.	By 2024, we will determine clear targets and schedules to achieve the carbon neutrality of production by the target year.
In 2019, carbon-neutral energy accounted for 63.6% of electricity. Steam and district heat are produced by using propane, as well as light fuel oil in part.	In December 2020, we started up an energy plant that mainly uses side streams from the forest industry and recycled wood. In November 2020, we completed the expansion of our district heating network to include the mining depot. As a result, light fuel oil will no longer be used for heating the industrial hall in the mining depot. The energy company will provide us with the information on the share of carbon-neutral energy of electricity by the end of summer 2021.	In addition to actions to improve energy efficiency the potential for the exploitation of wind and other renewable energy will be explored.	In 2024, carbon-neutral energy accounts for 100% of electricity and more than 90% of steam and heat is produced by using renewable energy.

TABLE CONTINUES ON THE NEXT PAGE

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
In the winter, most of our industrial buildings are heated by using district heat. Heating is hardly needed in the summer; on the contrary, most buildings need cooling because of the high temperature of the process solution. Opportunities to use waste heat in hydrogen plants have been identified.	We started a waste heat recovery project at the hydrogen plant in 2020. In May 2021, waste heat recovery is in use. This is expected to reduce the energy produced at heating plants by 5 MW. No measures were taken for the energy efficiency of buildings in 2020.	Between 2022 and 2024, we will explore other opportunities to use process-based waste heat as well as ways to improve the energy efficiency of buildings. In particular, we are seeking a solution that enables us to reduce the consumtion of heating energy in the winter and cool the process facilities in an energy-efficient manner in the summer.	By 2024, we will design a solution to improve the energy efficiency of buildings and implement cooling in an energy-efficient manner. The proportion of process-based waste heat recovery out of the process stream and district heat used at the metals recovery plant is at least 15%.

Loading to natural waterways

Loading to natural waterways is one of the most significant environmental impacts of Terrafame's production. The metal concentrations of our purified discharge waters have been very low throughout the time of our operation, but the sulphate load has varied depending on precipitation. The company seeks to develop its operations in such a way that the sulphate load will not increase directly with precipitation and that sulphate can be recycled more effectively back into the process.

UN Global Compact: **Environment** (Principles 7 and 9)
UN Sustainable Development Goal **6 (Clean Water and Sanitation)**

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
Terrafame's water treatment is effective, and its metal emissions to discharge waters are very small. Our sulphate load has also fallen well below the annual quota, but the load is highly dependent on precipitation and the size of the areas under water collection. In rainy years, we have to remove water from the bioleaching cycle by means of iron precipitation, meaning that more sulphate ends up in discharge waters than during dry years. Only part of the sulphate has been recycled back to the metal plant.	In 2020, the sulphate load was 13,067 tonnes. The monthly permit limit was exceeded slightly during three months. At the annual level, however, the load was below the permit limit (16,000t). In 2020, around 70% of the sulphate was recycled back into the solvent circulation, because the two-line run model was not yet in use.	We will continue the systematic development of water management as a whole. The size of the areas under water collection will be reduced by closing areas that have been removed from use.	Purified process-based water will primarily be used as recycled water in production in metals recovery or bio-leaching. 100% of the sulphate ending up from the process in water treatment will be recycled back into the solution circulation. The sulphate concentration and sulphate load per month are below the limit values under all circumstances.
Rain and drainage water is collected on the industrial site (e.g. open pit) to be used in the process or treated and directed out of the area. In rainy years, sulphate from process-based purified waters ends up in discharge waters.	The two-line run model was introduced in the centralised water treatment plant in the fourth quarter of 2020.	The efficiency of the processes and run-off water collection at the centralised water treatment plant will continue to be improved.	The two-line run model at the centralised water treatment plant enables the more efficient separation of collected waters. Low-sulphate collected waters are either used as raw water or treated and directed out of the area.

Water treatment sludge and local lakes

Water treatment sludge generated during the early stages of the mine is stored in different parts of Terrafame's industrial site, waiting for its final disposal. The goal is to find a safe place for the final disposal of the water treatment sludge in the near future. The old discharge routes of the mine are located near small local water bodies, on which the mine operations have had clear impacts. The goal is to remediate the small water bodies not related to production operations, if they do not recover naturally.

UN Global Compact: **Environment** (Principles 7 and 9)
UN Sustainable Development Goal **6 (Clean Water and Sanitation)**

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
Water treatment sludge generated during the early stages of the mine is stored in ground-based pools and so-called "geotubes" in different parts of Terrafame's industrial site. An EIA procedure and EIA planning are in progress concerning the final disposal of the sludge.	The EIA procedure is being finalised and will be completed in the summer of 2021.	With regard to the water treatment sludge, the remediation work is expected to start in 2021–2022, and will take several years. The EIA of the final disposal of the sludge will be completed in the summer of 2021. An environmental permit application will be filed with the Regional State Administrative Agency for Northern Finland in the autumn of 2021.	The final disposal of the water treatment sludge has started, and the first ground-based pools have been cleaned. The cleaning of the areas and the final disposal of the sludge will continue in the coming years.
As a result of operations during the early stages of the mine, three lakes (Salminen, Kalliojärvi and Kivijärvi) along its old water discharge routes have been artificially stratified due to sulphate. Spring circulation and full circulation took place in Kalliojärvi in 2019, and the lake has almost fully recovered.	The remediation plan for Salminen was completed in January 2021. An environmental permit application concerning the remediation of Salminen was filed in early 2021 as a supplement to the main environmental permit.	The most recent monitoring results concerning Kivijärvi will be reviewed during 2021, and the need for its remediation will be assessed based on the results. The remediation of Salminen has been tentatively scheduled to begin in 2022.	Kivijärvi has been restored to close to its natural state. Part of Salminen will be covered by construction, and the rest of the lake has been remediated. A concrete plan for the remediation of Ylä-Lumijärvi.

YMPÄRISTÖTARKKAILU

Environmental impacts are extensively monitored

As an integral part of the sustainability of its operations, Terrafame continuously monitors its environmental impacts. The impacts of operations on the surrounding natural environments and their species are examined in accordance with a monitoring programme approved by the authorities. The programme includes monitoring emissions to the water and air, the quality of local water bodies, and dust, noise and vibration generated by the mine, among other aspects. The monitoring programme is implemented by Eurofins, an external expert specialising in environmental monitoring and analysis. Its certified environmental experts take samples monthly for analysis by accredited environmental laboratories.

The state of the surrounding water bodies is monitored particularly closely. Thousands of samples are taken from nearby water bodies every year. The monitoring covers a total of 18 lakes and 16 rivers and streams. The impacts on fish and fishing are monitored by means of test fishing, for example. Species under close monitoring include phytoplankton, benthos, aquatic plants, bats and wood ants.

We also take a large number of voluntary environmental samples from the mine area and its surroundings. In addition, we collect and analyse observations made by our neighbours about dust, odour, vibration and noise, for example. Monitoring enables us to accurately target improvement measures.

FOR MORE INFORMATION ON TERRAFAME'S ENVIRONMENTAL MONITORING AND ITS RESULTS IN FINNISH: WWW.TERRAFAME.FI > YMPÄRISTÖ

Reuse of waste

Terrafame's operations generate extractive waste, such as waste rock, metal-containing sludge and other production side streams. Pure waste rock is put into earthworks in accordance with the permit conditions. In addition, the aim is to use bioleaching in the management of metal-containing side streams and to prevent the generation of new industrial waste fractions. Hose and pipe waste generated during bioleaching is one of the most significant waste fractions, other than the extractive and process waste fraction. Terrafame has an agreement with a partner that can use plastic waste as a raw material for new hoses and pipes.

UN Global Compact: **Environment** (Principles 8 and 9)
UN Sustainable Development Goal **12 (Responsible Consumption and Production)**

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
In 2019, the utilisation rate of ordinary municipal and industrial waste was 88.2%. Municipal and industrial waste includes all but extractive waste.	In 2020, the utilisation rate of municipal and industrial waste increased to 91%.	Increasing advice on waste, improving markings on waste containers, enhancing the efficiency of department-specific monitoring.	The utilisation rate of ordinary municipal and industrial waste is more than 95%.
Around 3,500 tonnes of hose and pipe waste (plastic waste) is generated in the area annually. This waste can be disposed of in the waste rock area in accordance with the environmental permit. The hoses and pipes in the primary leaching area are collected before removing the pile, meaning that recycling opportunities for plastic waste have been studied. In the secondary leaching area, the used hoses are left inside the pile.	The recycling of plastic waste was successfully tested under a trial operation permit in the summer of 2020. During the experiment, around 3,500 tonnes of plastic waste was pre-treated for recycling. Plastic hoses and pipes are crushed on a tight field and washed. The washing water is returned to the process. The partner uses the crushed and washed plastic to produce new irrigation hoses and plastic pipes for Terrafame.	The recycling of new plastic waste, as well as the hose and pipe waste stored in the area, will continue in the coming years if the operating permit application filed for this purpose is approved. Hose and pipe waste has been stored in the area, and this waste will also be recycled.	Around 4,000 tonnes of plastic raw material is processed and delivered annually to be reused in the production of hose and pipe materials for Terrafame. For several years, the amount of material recycled annually will be higher than the amount of waste generated per year, because hose waste is stored in the area, and this waste will also be recycled.
Of process-based side streams, the pre-neutralisation sludge from the metal recovery plant is currently recycled. The sludge is placed in the secondary leaching area to recover and reuse the metals contained in it.	Crude and activated carbon waste generated at the battery chemicals plant are supplied for futher treatment.	The reuse of process-based side streams will increase with the introduction of the battery chemicals plant. The reject solution from the battery chemicals plant is directed into the solution circulation to reuse the metals contained in the solution and also reduce the consumption of sulphuric acid.	Process-based side streams are recycled as efficiently as possible to reduce the generation of waste and the need for its piling. At the same time, the metals contained in the side streams are reused in production.

Safety

Safety is one of the core values at Terrafame, and the continuous development of a safety culture has been one of the main priorities since the company was established. Operations within the industrial site must be safe for both the company's own employees and those of its partners in all circumstances and situations. We aim for zero accidents.

UN Sustainable Development Goal **8 (Decent Work and Economic Growth)**.

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
In 2019, the accident frequency rate (LTIFR$_1$) among Terrafame's employees was 9.6. The accident frequency rate for companies operating regularly in the area was 17.5. The accident frequency rate for the companies involved in the battery chemicals plant construction project was 32.9.	The accident frequency rate decreased in 2020 as a result of systematic work. The ROTI project started late in the year focuses on the company's safety culture. In addition, induction programmes have been further improved to prevent accidents among partners in particular. At the end of 2020, the accident frequency rate (LTIFR$_1$) was 8.3 among Terrafame's own employees, 9.7 for companies operating regularly in the area and 11.4 for companies involved in the battery chemicals plant construction project.	Between 2021 and 2024, safety work will be continued systematically to improve the safety of Terrafame's own employees and those of the companies operating frequently on the site.	The accident frequency rate (LTIFR1) for Terrafame's own employees and its partners is below 2.5.

OCCUPATIONAL SAFETY

Towards safer work

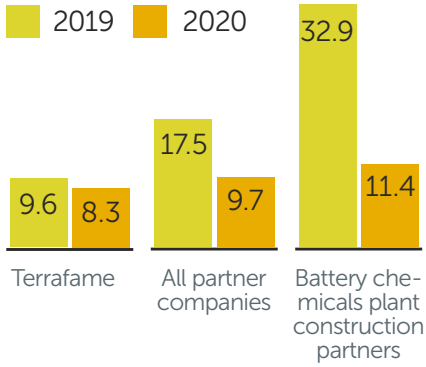
Safety is the first priority in all work at Terrafame. This is why the company has worked systematically to improve its safety culture. The results are already visible: Terrafame had no lost-time accidents during the first quarter of 2021.

In 2020, the focus of occupational safety was on developing partner companies' safety culture. In addition, a safety park was built on the industrial site to provide training for employees, and the role of safety was further emphasised in the renewed induction programme. In early 2021, the company started the ROTI programme to further develop operating models to ensure the continuous improvement of safety at work and reliable production. Through the programme, Terrafame is focusing on developing its safety culture: personal accountability for safety and an immediate response to detected safety issues.

Terrafame aims to be among the industry leaders in occupational safety. Through a permanent change in its work culture by means of the ROTI programme, Terrafame aims to reduce its accident frequency rate (LTIFR$_1$) to 2.5 for its own employees and partners by 2024.

LOST-TIME INJURY FREQUENCY

Accidents leading to more than one day's absence per million hours worked (LTIFR$_1$)



Personnel and equality

Diversity and equality are resources that promote the well-being and success of every Terrafame employee. The equal treatment of employees also ensures that Terrafame has access to the best knowledge and skills in the sector.

UN Global Compact: **Workforce** (Principles 3 and 6).
UN Sustainable Development Goas **5 (Gender Equality)**, **8 (Decent Work and Economic Growth)**, **10 (Reduced Inequalities)** and **16 (Peace, Justice and Strong Institutions)**.

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
Cooperation between the employer and the employees is more extensive than the level required by the law. Women account for around 10% of all employees. The equality plan was reviewed in May 2020.	The focus for 2021 is to support the working capacity of older employees. A working group has been established for this purpose. Coaching for new supervisors has been introduced in 2021 to improve the capabilities of employees and supervisors.	Promoting diversity in the workplace by further developing recruitment procedures. Promoting equality in the workplace by setting targets and monitoring mechanisms for women's career development, for example. Developing cooperation with educational institutions to increase the proportion of women in education in this field. Participating in diversity projects (e.g. Girls in Technology).	Social responsibility is an integral part of the company's operating processes. Diversity is seen as a resource for the workplace community. The proportion of women of all employees has increased. Our processes support equality in all respects.

Training

Highly competent employees are one of Terrafame's key success factors. We are investing in training for our own employees. We are also making a significant contribution to the development of training in the process industry and electrical automation technology in the Kainuu region. Terrafame's educational cooperation also provides professionals for the needs of other industries.

UN Sustainable Development Goal **4 (Quality Education)**

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
In 2019, we introduced an apprenticeship training programme to provide process technology professionals for Terrafame. The programme continued in 2020. In 2018, we donated a three-year principal lecturer position in process technology to Kajaani University of Applied Sciences. Terrafame employees participated in a retraining programme that started in 2019 for electrical and automation engineers.	The need for training increased in 2020 as a result of the construction of the battery chemicals plant in particular. Since 2019, a total of 79 students selected from outside Terrafame have started the apprenticeship training programme in the process industry, of whom 20 graduated in the spring of 2021.	Apprenticeship training in process technology is provided as needed (an estimated 25-50 people per year will be provided with training in 2021 and 2022). Kajaani University of Applied Sciences offers an opportunity for around 40 mechanical engineers specialising in process technology annually. Electrical automation retraining is provided as needed.	We have provided more than 100 process industry professionals with training for the needs of Terrafame and other process industries. Training in the process industry and electrical automation technology has been developed for the Kainuu region with support from Terrafame.
Of our own personnel, we provide around 30 employees annually with training in the vocation qualification programme in the process industry and in special vocational qualification programmes. Of our employees, around 90% have completed a degree corresponding to their job requirements.	Of Terrafame's current personnel, 30 employees have completed a vocational or special vocational qualification in their field alongside their work.	Supporting and encouraging participation in retraining and further training programmes.	As a result of apprenticeship training and retraining, at least 95% of Terrafame's employees have completed a degree corresponding to their job requirements.

Regional economy

Terrafame is a very important private operator in the Kainuu economic area. The company represents a significant portion of the regional GDP, and will continue to grow with the start-up of its battery chemicals plant. Including its partners in the region, Terrafame directly employs around 1,500 people. In addition to having direct economic impacts, Terrafame's operations generate significant indirect cash flows.

UN Sustainable Development Goas **8 (Decent Work and Economic Growth) and 9 (Industry, Innovation and Infrastructure).**

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
Terrafame's net sales in 2019 were EUR 310 million. At the end of 2019, Terrafame had 754 employees, and its partners in the region had 735 employees. Terrafame represents around 11% of the GDP of the Kainuu region (Ramboll Finland 2016). Its battery chemicals plant is under construction, employing up to 500–600 people during construction.	In 2020, Terrafame's net sales increased year-on-year, and were EUR 338.3 million. The company had 870 employees, and its partners in the region had 1,130 employees. The construction of the battery chemicals plant progressed as planned. The production ramp-up of the plant started up in June 2021. The operating personnel of the plant consist of 141 people.	The production of battery chemicals is expected to increase the company's net sales from late 2021.	In 2024, Terrafame's net sales will be almost double compared with 2019. According to a study on the regional economy, Terrafame accounts for around 19% of the GDP of the Kainuu region (Ramboll Finland 2018), provided that no other major new industries emerge in the area.
The planning of the utilisation of Kolmisoppi and the expansion of the mining concession, as well as the related environmental impact assessment, are in progress.	The assessment of the significant environmental impacts of the project is nearing completion. The assessment and its results will be reviewed with the monitoring group after the completion of the assessment report in June. After this, the assessment report will be submitted to the local Centre for Economic Development, Transport and the Economy for public notices.	The regional economic impacts of Kolmisoppi were examined during the environmental impact assessment in the spring of 2021. The results of the report will be published in the context of the evaluation report in the summer 2021. An environmental permit application for the utilisation of Kolmisoppi is scheduled to be filed with the Regional State Administrative Agency in the autumn of 2021. The construction related to the opening of Kolmisoppi will start in 2024–2025.	The utilisation of the Kolmisoppi deposit and the expansion of the mining concession will enable Terrafame to continue its operations for up to 50 to 60 years.

Fairness and good governance

In all our operations, we are committed to good governance and transparency. Our partner companies and the operators in our supply chains must also comply with Terrafame's operating principles. We are aiming to implement new commitments and international systems in the next few years to demonstrate the sustainability of our operations.

UN Global Compact principle: **Anti-Corruption**
UN Sustainable Development Goal **16 (Peace, Justice and Strong Institutions)**

TABLE CONTINUES ON THE NEXT PAGE

Starting point	Situation in June 2021	Measures for 2021–2024	Target for 2024
Terrafame has certified quality, safety and environmental management systems in place (ISO 9001, ISO 45001, ISO 14001).	Several assessments of management and responsibility systems were carried out during 2020. The compliance of Terrafame's practices with these systems was ensured through these assessments. An external audit of the ISO 9001, ISO 45001 and ISO 14001 management systems was conducted during the year.	Between 2021 and 2014, an energy management system will be built and certified in accordance with ETJ+ or ISO 50001, and the implementation of an ISO 27001 information security management system will be explored.	New management systems have been certified and are part of normal operations.
A commitment has been made to the Finnish Network for Sustainable Mining. Half of the tools have been assessed, and the result of these self-assessments is C-AA.	With regard to the Finnish Towards Sustainable Mining (TSM) Standard, Terrafame conducted self-assessments and an internal audit during 2020.	An external assessment will be carried out in the autumn of 2021. An action plan will be prepared in 2021 to achieve Level A across the board.	Level A has been achieved in all aspects covered by the Finnish Towards Sustainable Mining (TSM) Standard.
Production is sustainable and transparent, as well as being respectful of human rights, but a need to demonstrate corporate responsibility through international systems has also been identified. Providers of services and suppliers of materials are required to comply with the company's Code of Conduct and its sustainability policy, as well as with the UN Global Compact principles. The operations of partner companies within industrial site are audited regularly. The operations of equipment suppliers are audited on-site if the supplier fails to demonstrate the sustainability of their operations through reliable international systems. A supplier evaluation tool was introduced for the use of employees who place orders for work and contract managers.	Terrafame joined the UN Global Compact initiative in 10/2020. This commitment strengthens Terrafame's corporate citizenship and its work for more sustainable business development. In 2020, Terrafame participated in the Status of Human Rights Performance of Finnish Companies project. Suppliers have been assessed regularly to improve operations and cooperation. In Q1 2021, a total of 3 supplier audits were conducted using the supplier evaluation tool introduced in 6/2020. During the first months of the year, partner meetings were held to discuss the company's operating principles, the principles of the UN Global Compact initiative and the zero tolerance rules adopted by the company as part of enhanced safety work in 2020. A total of 150 representatives of partner companies participated in the meetings.	The verification of chemical operators in supply chains is further developed by joining the Together for Sustainability (TfS) network. The first Together for Sustainability audit will be carried out in the summer of 2021. The prerequisites for joining the chemical industry's Responsible Care sustainability programme will be examined in 2021. Human rights aspects will be included in partner company audits. As a follow-up measure of the SIHTI project, a human rights assessment will be carried out in 2021 to identify human rights risks and determine the related development needs and measures.	Production is sustainable and transparent, as well as being respectful of human rights, and corporate responsibility has also been demonstrated by means of international systems based on the ISO 26001 standard. Terrafame has not had any violations of labour laws or human rights.
Terrafame makes purchases through competitive bidding. Related party registers are also checked when selecting partners. Operating principles have been created for the company in case of possible misconduct.	In April 2021, the company introduced a whistle-blowing channel for employees to report any misconduct.	Reports submitted through the whistle-blowing channel are monitored. All misconduct will be resolved as soon as possible.	The whistle-blowing channel is well-known among the employees. No misconduct is detected.

Terrafame in numbers

Nickel production 2020

28,740t

2019 27,468t

Zinc production 2020

55,100t

2019 55,222t

Net sales 2020

EUR 338.3 million

2019 EUR 310.4 million

EBITDA 2020

EUR 23.8 million

2019 EUR 32.0 million

Capital expenditure 2020

EUR 201.8 million

2019 EUR 130.6 million

Salaries and remuneration 2020*

EUR 38.8 million

2019 EUR 31.8 million

*Excluding the members of the Management Team. For a detailed description of the remuneration plans for the management, please see the Remuneration Report at www.terrafame.com > Terrafame Ltd > Reporting.

ENVIRONMENT		2020	2019
Environmental investments	**EUR million**	**31.1**	**32.2**
Environmental operating costs	**EUR million**	**20.7**	**14.2**
Provisions for environmental restoration	**EUR million**	**159.1**	**157.4**
Collaterals for environmental restoration	**EUR million**	**129.6**	**122.0**
Ore mined	**Mt**	**16.9**	**14.4**
Waste rock mined	**Mt**	**16.5**	**17.9**
Process chemicals total	**t'000**	**445.8**	**380.3**
pH adjustment chemicals	t'000	359.2	294.2
Gas plant's raw materials and metals production plant's precipitation chemicals	t'000	70.1	70.4
Explosives	t'000	13.3	13.3
Others	t'000	3.1	2.4
Total energy use	**Tj**	**2,329.6**	**2,300.2**
Electricity	Tj	1,543.3	1,433.0
Fossil fuels	Tj	774.5	867.2
Renewable fuels[1)]	Tj	11.9	-
Total water use	**Mm³**	**3.5**	**4.5**
Lake Kolmisoppi	Mm³	1.9	3.3
Household water	Mm³	0.03	0.03
Recycled water	Mm³	1.6	1.1
Total recycled water	%	44.5	24.3
Volume of water directed to surface waters	**Mm³**	**8.0**	**4.5**
Nickel loading	kg/a	232.6	169.2
Zinc loading	kg/a	498.8	332.6
Copper loading	kg/a	11.7	8.4
Manganese loading	kg/a	8,175.9	3.9
Sulphate loading	kg/a	13,067	6,632
Sodium loading	t/a	1,117	696
Conventional municipal and industrial waste	**t**	**4,321**	**3,782**
Hazardous waste	**t**	**527**	**499**
Waste utilised as materials or energy	**%**	**91.2**	**88.2**
Process waste	**t'000**	**16,978**	**18,119**
Gypsum	t'000	346.4	117.4
Precipitation from preneutralization	t'000	118.4	101.4
Waste rock	t'000	16,513	17,900
Utilisation of process waste	**%**	**0.7**	**0.6**

1) New, reported first time in the 2020 review.

TABLE CONTINUES ON THE NEXT PAGE

ENVIRONMENT		2020	2019
Carbon dioxide (CO_2) emissions[2)]	**tCO_2e**	**222,914**	**233,073**
Direct CO_2 emissions (Scope 1)	tCO_2e	91,052	97,977
Indirect CO_2 emissions from purchased electricity generation (Scope 2)	tCO_2e	71,280	77,220
Other indirect CO_2 emissions (Scope 3)	tCO_2e	60,582	57,877
Sources of CO_2 emissions[2)]			
Limestone	%	25	19
Electricity	%	30	27
Light fuel oil	%	24	19
Propane	%	6	25
Burnt lime	%	18	4
Heavy fuel oil	%	0	0
Burnt wood[3)]	%	0	-
New land used during the year	**ha**	**85**	**90**
Operating areas with a closing plan	**%**	**100**	**100**
Neighbours' environmental observations	**pcs**	**8**	**13**

PERSONNEL		2020	2019
Number of personnel at the end of the year		**870**	**754**
Average age of personnel	**years**	**41.4**	**40.8**
Permanent employees	**%**	**88.9**	**89.8**
Female employees	**%**	**10.4**	**10.2**
Employees from Kainuu	**%**	**84.0**	**89.0**
Training days	**days/person**	**3.1**	**4.2**
Employee turnover	**%**	**1:1**	**1:1**
Ratio of basic salary women to men			

OCCUPATIONAL SAFETY AND HEALTH		2020	2019
Number of lost-time injuries, LTI	**pcs**	**11**	**11**
Lost-time injury frequency, $LTIFR_1$	**pcs/million hours worked**	**8.3**	**9.6**
Total recordable injuries, TRI	**pcs**	**44**	**56**
Total recordable injury frequency, TRIFR	**pcs/million hours worked**	**33.2**	**48.9**
Seriousness of injuries	**days/lost-time injuries**	**22**	**19.3**
Occupational diseases	**persons**	**1**	**0**
Accidental deaths at work	**persons**	**0**	**0**
Sickness absences	**days/person**	**11.3**	**12.0**
Sickness absences	**%**	**4.8**	**5.0**

LTI = accidents leading to more than one day's absence, does not include accidents during commuting (Lost Time Injury)
$LTIFR_1$ = accidents leading to more than one day's absence per million hours worked, does not include accidents during commuting (Lost Time Injury Frequency)
TRI = total recordable injuries
TRIFR = number of accidents per million hours worked (Total Recordable Injury Frequency)

2) Reporting specified in the 2020 review.

3) New, reported first time in the 2020 review.

Terrafame

Enhancing low-carbon mobility
with responsible battery chemicals

Malmitie 66
88120 Tuhkakylä
Finland
www.terrafame.com